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different from those of Hering. In this case, however, the disturbance was apparently more serious, for the red and green of the perimetrical tests could not be seen on any part of the diseased half-retina, and the sensitiveness to white light was a little less than normal. The case, of course, justifies the same conclusions as Hering's above. In both cases a condition of things has been brought about on the central parts of the retina by disease, which exactly corresponds with that on the more peripheral parts of the normal eye.

The Knee-jerk and its Physiological Modifications. By Prof. H. P. BOWDITCH and Dr. J. W. WARREN. *Journal of Physiology*, XI, 1890, 25-64.

It has been known for some time that muscular contractions and various sensory and other conditions affecting the central nervous system could considerably re-inforce the knee-jerk, also that the re-inforcing contraction must precede the stroke upon the tendon by a certain interval. To the study of this point the experiments of the present paper were directed. The apparatus was somewhat complicated, but is marked by the clever devices common to Dr. Bowditch's laboratory, and is fully described. The general results may be summarized somewhat as follows: A voluntary muscular contraction (in response, after the manner of reaction-times, to a bell-stroke) increases the knee-jerk, if the blow on the ligament falls at the time of the contraction, and in lessening degree if it follow within 0.22-0.6 sec. A larger interval than this resulted in eight cases in a decrease of the knee-jerk below its normal amount, to which, however, it returned as the interval was extended to 1.7-2.5 secs. In 2 cases there was no such negative phase. In the majority of cases, therefore, contraction of the arm muscles produces for a short time a state of increased excitability in the part of the spinal cord that mediates the knee-jerk, followed in turn by a short period of decreased excitability. Sensory re-inforcements were investigated, by the explosion of torpedoes, the flashing of light into the eyes, a blast of air on the conjunctiva, on the nasal mucous membrane, on the neck, and on the knee. These experiments were tried on fewer subjects than the motor re-inforcements (3 or less) and the individual differences are marked. With a portion of the subjects there is a positive phase but hardly any negative, while in one both phases are plainly marked. The experiments were monotonous and in some the subject fell asleep. Oncoming drowsiness decreases the extent of both normal and re-inforced knee-jerks, and sound sleep abolishes them, an effect the opposite of that produced by the same conditions upon the superficial reflexes. The authors make the interesting suggestion that the individual variations in the activities of the central nervous system which their experiments show may open the way to an understanding of those general psycho-physic modes of response vaguely known as temperaments.

Zur Messung der Reactionszeit. OTTO DUMREICHER. Inaug. Diss., Strassburg, 1889.

Twenty-one pages of this dissertation are devoted to a historical résumé of "personal equation" and reaction-time studies, in particular of those among the latter where the stimulus used was electrical and applied to the skin. Another considerable section is devoted to the description of the apparatus used, which included several ingenious devices of Ewald's—among the rest a new chronoscope, and a reaction key which is so arranged that the stimulus can be applied to the tip of the finger with which the reaction is made. The chronoscope, which is a very promising instrument, consists essentially of an electro-magnet, the armature of which works upon a toothed wheel connected with a pointer moving over a dial. If, now, a tuning-fork interrupter is intro-